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Poverty, Global Health, and Infectious Disease: Lessons from Haiti and Rwanda

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The association between poverty and communicable disease is evident from a cursory exercise in cartography. The maps of those living on less than US \$2 a day and the epidemiology of human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS), malaria, tuberculosis (TB), and many other infectious diseases coincide nearly exactly (**Fig. 1**). Countries with higher incomes per capita tend to enjoy longer life expectancies (**Fig. 2**). Although notable exceptions exist in some low

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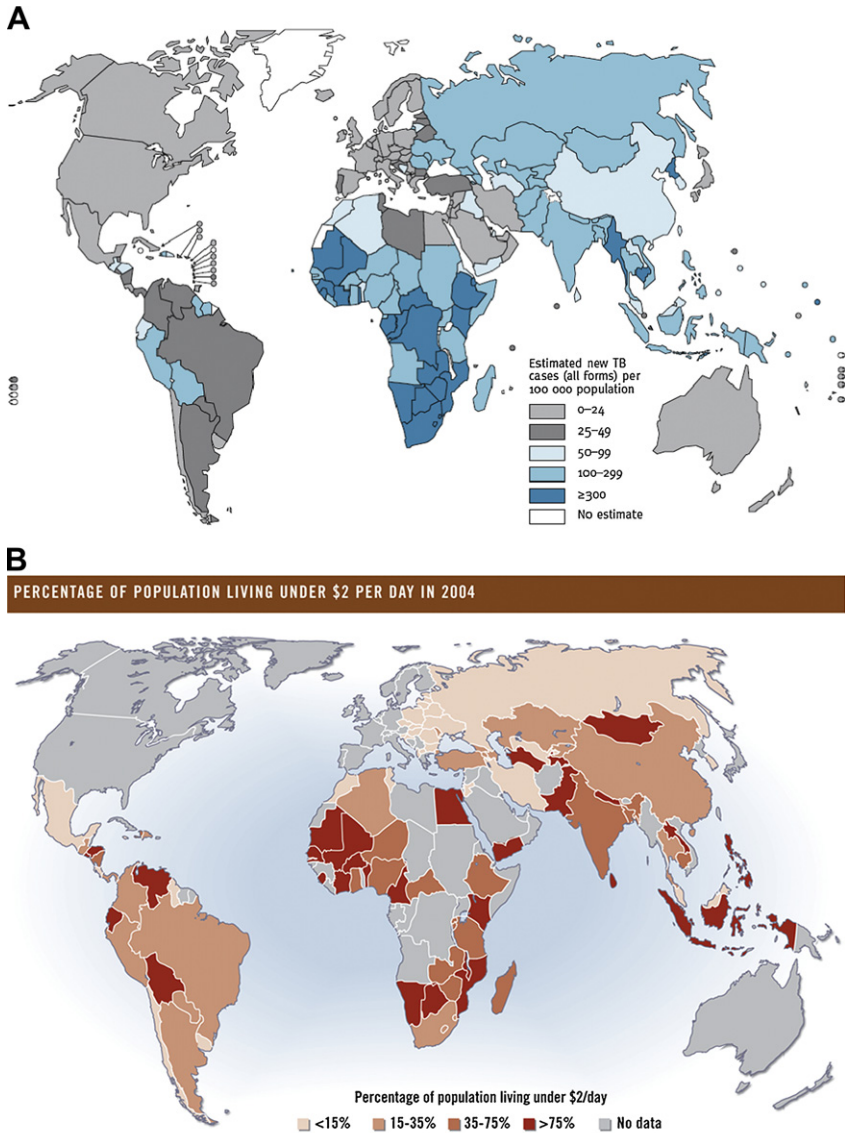


Fig. 1. (A) Estimated TB incidence by country, 2009. (Adapted from WHO Global Tuberculosis Control, 2010.) (B) Global poverty map. (Reprinted from The World Resources Institute; with permission.)

income settings, such as Cuba or Kerala State, where India has an excellent performance on population health measures, these instances represent important exceptions to the general rule. What are the linkages between poverty and ill health? How can the vicious cycle of destitution and sickness be broken?

Poverty is arguably the greatest risk factor for acquiring and succumbing to disease worldwide, but has historically received less attention from the medical community than genetic or environmental risk factors. Several factors likely contributed to this oversight: first, being poor is not considered a disruption of normal physiologic

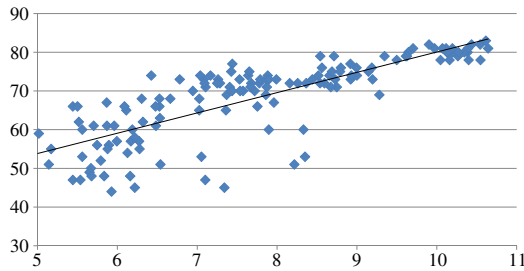


Fig. 2. Life expectancy at birth, total (years) versus log gross domestic product (GDP) per capita (constant US \$2000). Data are from the most recent year of complete data, 2007, and include 146 countries with a population more than 1,000,000. (Data from The World Bank World Development Indicators.)

function. Physicians and basic scientists viewed themselves as ill-equipped to understand or manipulate an individual's socioeconomic status. Second, unlike the largesse dedicated to finding technical solutions for population health problems, funding for research dedicated to understanding and alleviating poverty was sparse. Third, although some acknowledged that poverty plays a pivotal role in determining disease vulnerability and outcomes, the resultant solutions intended to redress poverty were often wrongheaded. For example, structural adjustment programs (SAPs) intended to increase gross domestic product (GDP) growth often involved austerity measures, such as cuts in government spending, currency devaluation, and privatization. These macroeconomic shifts involved intertemporal trade-offs (temporary pain for long-term gains) and completely ignored the path-dependent nature of health care. If a child does not get vaccinated, a pregnant mother lacks antenatal care, or a TB clinic goes without drugs, the health consequences can reverberate for generations.

The tide in public health and medicine has started to shift. The global HIV/AIDS crisis brought into sharp relief the vulnerability of financially strapped health systems to epidemic disease and revealed disparities in health outcomes along economic fault lines. The protestations of injustice regarding the withholding of life-sustaining antiretroviral treatment from the developing world, made first by patient-activists, then students, and (more gradually) academics and politicians, have provided a template for addressing other diseases linked to poverty. This hope was echoed in the preface of Farmer's¹ *AIDS and Accusation*: "If AIDS care becomes a right rather than a commodity...we have no more excuses for ignoring the growing inequality that has left hundreds of millions of people without any hope of surviving preventable and treatable illnesses...Taking on AIDS forcefully would allow us to start a 'virtuous social cycle,' long overdue." And if a rights-based approach to controlling communicable disease falls on deaf ears, enlightened self-interest might still invoke concern. Severe acute respiratory syndrome (SARS), multidrug-resistant TB, and H1N1 remind the developed world of its porous borders. Many investors view the developing world as a potential market for their goods, and military strategists foresee the danger of allowing states to collapse from pandemic disease.

Economic thought regarding the link between poverty and disease has also evolved. Sen's² landmark treatise, *Development as Freedom*, exposed the false dichotomy between political and social and economic rights. Sen² posited that development was broader than income: an affluent, stable democracy could not be achieved without an educated and healthy populace. "There is a deep complementary between individual agency and social arrangements," Sen² wrote. And more pointedly: "Development requires the removal of major sources of unfreedom: poverty as well as

tyranny, poor economic opportunities as well as systematic social deprivation, neglect of public facilities as well as intolerance or overactivity of the repressive states.” Such insight paved the way for the creation of the Human Development Index (HDI) 20 years ago. The HDI is a composite measure of health, education, and income and was designed by Mahbub ul Haq to counter the inordinate reliance on income alone as a measure of well-being. Building on the conceptual framework created by Sen and parameterized (albeit imperfectly) by ul Haq, Jeff Sachs became the next economist to make a broader concept of development operational by promoting the Millennium Development Goals (MDGs). The 8 MDGs, endorsed by 189 countries, are time-limited commitments to reduce poverty, expand educational opportunities, promote gender equality, and safeguard population and environmental health.³

This article discusses the complex relationship between poverty and communicable disease, and draws on experience gleaned from working in solidarity with the destitute sick in Haiti, Peru, Rwanda, and elsewhere, as well as from anthropologic and economic theory and evidence. We conclude that the twin afflictions of poverty and disease cannot be treated in isolation and require a biosocial understanding to achieve lasting health gains.

POVERTY AND SUSCEPTIBILITY

One link between poverty and disease that is readily observable to most physicians is the increased vulnerability of the poor to communicable diseases, and the lack of medical care once infected. This link was eloquently documented by German pathologist Rudolf Carl Virchow, investigating an outbreak of typhus in the nineteenth century:

*The population had no idea that the mental and material impoverishment to which it had been allowed to sink, were largely the cause of its hunger and disease, and that the adverse climatic conditions which contributed to the failure of its crops and to the sickness of its bodies, would have not caused such terrible ravages, if it had been free, educated and well-to-do. For there can now no longer be any doubt that such an epidemic dissemination of typhus had only been possible under the wretched conditions of life that poverty and lack of culture had created in Upper Silesia. If these conditions were removed, I am sure that epidemic typhus would not recur. Whosoever wishes to learn from history will find many examples.*⁴

To prevent typhus from recurring, Virchow announced a radical prescription: medicine must concern itself with the social condition of the population, and characterize efforts short of that as palliative. Although daunting, these words inspired the creation of social medicine, and the veracity of Virchow's observations are reflected in modern epidemics.

The recent cholera epidemic in Haiti provides a current example. In early December 2010, the US Centers for Disease Control and Prevention (CDC) *Morbidity Mortality and Weekly Report* announced that the outbreak had spread nationwide. At that time, the Haitian Ministry of Public Health and Population (MSPP) reported 91,770 cases of cholera, including 43,243 hospitalizations and 2071 deaths. Deaths occur “as rapidly as 2 hours after symptom onset and [identify] important gaps in access to life-saving treatments, including oral rehydration solution (ORS).”⁵ Disentangling Haiti's dire health condition from historical, political, and economic concerns leads to the characterization of the epidemic as a medical disaster stemming from the twin natural disasters Haiti suffered in the last year: a 7.0 magnitude earthquake and subsequent flooding from Hurricane Tomas. However, a narrative that uses

phrases such as medical and natural implies inevitability and general inculpability. A more careful reading of the context in which the cholera outbreak has occurred proves such ahistorical views misleading.

The Republic of Haiti is the only nation tracing its genesis to a successful slave revolt. After more than a decade of war that destroyed the country's infrastructure and cost tens of thousands of lives, the French relinquished military control in 1804. However, France maintained financial repression by demanding that the fledgling nation pay damages for property losses incurred during the revolution. These demands marked the birth of Haiti's longstanding debt burden. As historian von Tunzelmann⁶ describes, Haiti was on the brink of humanitarian calamity even before the devastating earthquake of 2010:

... France gained the western third of the island of Hispaniola—the territory that is now Haiti—in 1697. It planted sugar and coffee, supported by an unprecedented increase in the importation of African slaves. Economically, the result was a success, but life as a slave was intolerable... After a dramatic slave uprising that shook the western world, and 12 years of war, Haiti finally defeated Napoleon's forces in 1804 and declared independence. But France demanded reparations: 150 [million] francs, in gold.

For Haiti, this debt did not signify the beginning of freedom, but the end of hope... By 1900, it was spending 80% of its national budget on repayments. To manage the original reparations, further loans were taken out—mostly from the United States, Germany and France. Instead of developing its potential, this deformed state produced a parade of nefarious leaders, most of whom gave up the insurmountable task of trying to fix the country and looted it instead.

Staggering debt obligations hampered Haiti's ability to provide basic sanitation and public health interventions to its population. According to the United Nations Development Program (UNDP) Human Development Report, Haiti ranks 145th out of 169 countries.⁷ It has occupied the unenviable position of poorest nation in the Western Hemisphere for decades. Income per capita is US \$560, 54% of Haitians live on less than US \$1 a day, and 78% live on less than US \$2 a day. In 2005, total external debt owed was US \$1.5 billion, more than one-quarter of total GDP,⁸ whereas Haiti spent only 1.2% of GDP on health care.⁷ Widespread lack of access to clean water has been a chronic threat to the health of the Haitian population.⁹ In 2007, only 63% had access to an improved water source, and only 17% had access to sanitation.¹⁰

The earthquake on January 12, 2010 (which killed an estimated 250,000 people and displaced more than one-tenth of the Haitian population) turned the water situation in Haiti from bad to worse. It was in the context of hundreds of thousands of people living in refugee camps (1 million on the outskirts of Port-au-Prince alone) with intermittent access to drinking water and gross underprovision of sanitation facilities that cholera took hold.¹¹ Recent findings published in the *New England Journal of Medicine* and using third-generation single-molecule real-time DNA sequencing found that the clonal strain causing the Haiti outbreak was genetically similar to those previously isolated in Bangladesh. The study investigators concluded that, "Collectively, our data strongly suggest that the Haitian epidemic began with introduction of a *V. cholerae* strain into Haiti by human activity from a distant geographic source."¹² These results corroborated those from the CDC and the National Public Health Laboratory (NPHL) in Haiti.¹³ The initial CDC findings were released in early November and sparked protests against the Nepali UN peacekeepers quartered near the river presumed to be the source of the outbreak. At least 3 Haitians were killed.¹⁴ After a 100-year hiatus,

cholera has now gripped Haiti and has started to spread to the Dominican Republic.¹⁵ Given the increased virulence associated with this particular strain (the death rate in Haiti is 12 times higher than that of the 1991 Peruvian epidemic) there are calls from public health leaders to mass vaccinate the populations of the island and its closest neighbors.¹⁶ Taking into account the long view of Haiti's history, from slavery to colonialism, debt, despotic leaders, and a woeful undersupply of public goods, the cholera outbreak seems less like an unforeseen catastrophe and more like an event that Virchow would have easily predicted.

Neglected tropical diseases (NTDs) provide another example of how economic position can interact with host susceptibility. According to the World Health Organization (WHO), NTDs are defined by their association with poverty: "though medically diverse, neglected tropical diseases form a group because all are associated with poverty."¹⁷ Substandard housing, lack of access to safe water and sanitation, and inadequate vector control contribute to the efficient transmission of infection. Currently, of the world's 2.7 billion impoverished individuals, more than a billion people suffer from NTDs.¹⁷ Thankfully, there is growing attention to this matter among the international community. The first annual report on NTDs was released by the WHO in 2010. Director-General Margaret Chan refers to the MDGs in her preface and provides several examples of how eliminating NTDs would foster economic development: "Onchocerciasis and trachoma cause blindness. Leprosy and lymphatic filariasis deform in ways that hinder economic productivity and cancel out chances for a normal social life. Buruli ulcer maims...Human African trypanosomiasis (sleeping sickness) severely debilitates before it kills. Chagas disease can cause young adults to develop heart conditions, so that they fill hospital beds instead of the labor force," and so on.¹⁷ The emphasis on potential negative productivity implications associated with untreated NTDs is understandable. Like cancer and heart disease, NTDs do not travel widely. New justifications are needed to persuade the international community to intervene when the direct threat to the health of wealthy country inhabitants is muted. If the medical community is to be committed to global health equity and not simply to reducing morbidity or mortality from the cluster of diseases that most affect the wealthy world, a rights-based approach to health care must be adopted.

STRUCTURAL VIOLENCE AND RISK

As discussed earlier, poverty and associated disease rarely arise *de novo*. Heavy burdens of disease predictably strike those places, most often resource-poor communities, where structural violence weighs most heavily. Moreover, structural violence (institutionalized biases and inequalities including racism, elitism, gender inequality, militarism, and economic policy that fosters inequity) often emanates from global centers of power and privilege, and increases the risk of encounter with communicable disease.¹⁸

Rwanda's recent history makes these processes clear. The 1994 Rwandan genocide took an enormous toll on the population: at least 800,000 Rwandans massacred in 3 brutal months by approximately 15% of the population.¹⁹ However, what commonly escapes our memories is that the Rwandan genocide was predicated on far more than physical violence alone. Structural violence played a significant role in setting the stage. Uvin²⁰ has argued that an uncritical development enterprise, dominated by foreigners, contributed to the creation of the processes that led toward genocide. In *Aiding Violence*, he summarizes:

[A]id financed much of the machinery of exclusion, inequality, and humiliation; provided it with legitimacy and support; and sometimes directly contributed to

it. To their credit, some aid agencies—some nongovernmental organizations (NGOs) foremost among them—may have had different impacts; they may have softened some parts of the crises faced by ordinary Rwandans. Yet, by and large, aid was an active and willing partner in the construction of structural violence in Rwanda, as it is elsewhere in Africa.

Many weapons used in the genocide did not originate in Rwanda, but in many of the political and economic powers of the world.²¹

The physical and structural violence of the Rwandan genocide directly affected the spread of communicable disease. Systematic rape during the genocide served as a vector for HIV transmission.²² The exodus of Rwandans into refugee camps in the Democratic Republic of the Congo without adequate food, water, and sanitation gave rise to epidemics of infectious disease (such as cholera) that resulted in a crude mortality of 20 to 35 per 10,000 people each day.²³ Increased incidences of both malaria and tuberculosis have lasted far beyond the formal end of the genocide.²⁴

Careful attention to Rwanda's and Haiti's places in global history, economics, and politics shows that the forces of structural violence increase risk of communicable disease for resource-poor populations in ways that are distinct from the behavioral and cultural explanations uncritically circulated in academic literature and the popular press.

DISEASE AND DEVELOPMENT

Conditions of poverty and structural violence facilitate disease acquisition. It is straightforward to extend this analysis to document the impact of poverty on access to care and health outcomes. Since the 2001 report by the WHO Commission on Macroeconomics and Health, chaired by Jeff Sachs, attention has shifted to exploring how investments in population health can spur economic growth.²⁵ Given that most of the developing world is engaged in physically demanding agricultural labor, health setbacks likely have a greater impact there than in the wealthy world. In economic terms, the marginal returns to good health in the labor force are higher in poorer countries. However, there are other, more nuanced channels by which ill health can affect economic prospects. These channels include the interactions among health and demography, cognition, and investment behavior.

Health and Demography

There is a strong association between child survival and fertility. Total fertility rate (TFR; the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates) and mortality before 5 years of age (child mortality rate [CMR], the probability per 1,000 that a newborn baby will die before reaching the age of 5 years, if subject to current age-specific mortality) have a correlation coefficient of 0.876. **Table 1** shows the linear trend between these indicators.¹⁰ Explanations

Table 1 The association between fertility and mortality before 5 years of age				
Average mortality before 5 years of age	<50	50–100	100–150	>150
Average fertility rate	2.17	3.74	4.93	5.85

Data represent the average TFR and CMR of 187 countries for the 4 most recent complete years of data (2004–2008). Precise definitions of these measures are contained in the text.

Data from The World Bank World Development Indicators.

abound as to why the relationship between child survival and fertility are so robust. One view espoused by many demographers and economists is that families in societies where child survival is low tend to compensate for expected and actual child deaths by having more children. Nobel laureate and economist Gary Becker famously modeled this quality/quantity trade-off with respect to family size. Another explanation is that places with high child mortality also lack access to contraception, educational opportunities for women, and gender equality. Although desired family size is a difficult concept to define and measure, the World Bank does attempt to collect data on access to contraception and indices of gender inequality.¹⁰ Although the correlation between the gender inequality index and child mortality in the World Bank's indicators database is negligible (0.01), perhaps at least in part because of the small sample size (75 countries) and imprecise measuring, contraceptive prevalence is negatively correlated with child mortality (−0.32). Although a major focus of academic inquiry is the direction of causality in the fertility-CMR relation, it seems safe to assume that the relationship is bidirectional. These data imply that efforts to improve public health through the provision of either culturally appropriate family planning or pediatric care would also pay dividends in the other health sector. From an economic standpoint, household resources are divided among fewer individuals as family size shrinks. This division allows parents to invest more in their children's education and nutrition, potentially interrupting the intergenerational transmission of poverty.

Health and Education

As with the relationship between child survival and fertility, the interplay between health and education is complex. As mentioned earlier, more-educated mothers tend to have fewer and healthier children. Moreover, the returns from education in terms of increased wages or agricultural output give heads of households the financial opportunity to promote their own health and that of their children. David Barker, a British physician who noted a correlation between low birth weight and cardiovascular health in midlife, put forward the fetal origins hypothesis that the in utero environment has important consequences for health and cognitive abilities later in life. Several epidemiologists have since confirmed this association.²⁶ Almond,²⁷ an economist at Columbia, used the natural experiment of the 1918 Spanish influenza epidemic to assess the impact of fetal health on educational and labor outcomes. Pairing data from the pandemic with those from the 1960 to 1980 decennial US censuses, Almond²⁷ found that cohorts in utero during the pandemic displayed reduced educational attainment, increased rates of physical disability, lower income, and lower socioeconomic status compared with other birth cohorts. Similarly, Miguel and Kremer²⁸ analyzed a randomized control trial of deworming in Kenyan schools at the facility level designed to capture the positive externalities associated with reducing the transmission of helminths. Miguel and Kremer²⁸ found that the program reduced absenteeism from school by one-quarter, although there was no significant effect on test scores. A series of follow-up studies have shown that those who received deworming for a longer period of time enjoy higher wages years later. Taken together, these results suggest that health investments, especially early in life, affect educational attainment.

Health, Savings, and Investment

There is perhaps an even more subtle way in which health affects education and economic outcomes: through the channel of savings and investment. Economic growth theory has repeatedly underscored that savings and investment are engines of development,²⁹ but what explains why some countries invest more than others?

This question was first posed by John Rae writing in the early nineteenth century. As Frederick and colleagues³⁰ explain, “Like [his contemporary] Adam Smith, Rae sought to determine why wealth differed among nations. Smith had argued that national wealth was determined by the amount of labor allocated to the production of capital, but Rae recognized that this account was incomplete because it failed to explain the determinants of this allocation. In Rae’s view, the missing factor was ‘the effective desire of accumulation,’ which determines the ‘rate of time preference.’ The rate of time preference is a mathematical representation of the tendency individuals have to weight the present more heavily than the future when making decisions. It summarizes how willing consumers are to delay immediate consumption and instead invest or save their income.”³⁰ Thus, the relationship between the rate of time preference and savings behavior at the individual level can be linked to income growth and disparities at the aggregate level. Studies by psychologists and economists have shown that the poor discount the future more steeply than the wealthy.³¹ This result has given rise to the view that the poor are impatient or, more pejoratively, lack self-control. However, this rationale fails to account for the uncertainty and risks associated with living in poverty. In particular, how do health status and expectation of longevity influence one’s willingness to make trade-offs over time? Recent evidence from Sri Lanka sheds light on this question. Jayachandra and Lleras-Muney³² examined how a sudden drop in maternal mortality between 1946 and 1953 sharply increased the life expectancy of girls. This increase in turn led to greater investment in their education: Jayachandra and Lleras-Muney³² found that, for every extra year of life expectancy, literacy among girls increased by 0.7 percentage points (2%) and years of education increased by 0.11 years (3%). At Partners In Health, we often use the phrase *antidote to despair* to describe our work. Translating the language of social justice into the language of economics, the antidote is the extended time horizon afforded by longevity. Knowing that a healthy and well-fed tomorrow awaits may affect the psychology of those living in poverty. The impact of this health-led hope on investments in microenterprise, education, and complementary health inputs has yet to be fully measured.

APPLYING A BIOSOCIAL FRAMEWORK TO THE DESIGN OF HEALTH SYSTEMS

Having reviewed the ways in which poverty, structural violence, and infectious disease confine poor populations to vicious cycles of suffering and despair, we now examine the implications of these understandings on the design of health interventions. As shown by disease patterns in Haiti and Rwanda, social forces interact with human biology and affect who falls ill and who has access to care. Thus, use of a biosocial analytical framework provides a useful and effective tool for designing and implementing health interventions to address these inequalities. Failure to use a biosocial lens often gives rise to charity and development models of health intervention that replicate preexisting unequal structures. Such models localize blame for disease with the poor themselves. In contrast, a biosocial lens makes clear that disease among the poor results from the embodiment of structural violence and requires that any serious attempt to address disease in resource-poor settings incorporates efforts for social change. Through commitment to models built on the principles of social justice, we have found that advocacy and long-term partnerships with the public sector and the communities in which we work are indispensable to sustainable transformations in health that reduce suffering caused by infectious and chronic disease.

Biosocial understandings of disease in Haiti and Rwanda reveal that a sustainable response must not only make available the fruits of modern medicine (ie, diagnostic tools, pharmaceuticals, and trained clinicians) but must also address the consequences

of deep poverty: limited transportation, poor housing, and food scarcity, among others. In Haiti, Rwanda, and numerous other settings, Partners In Health and local partners provide care that integrates social and economic programs. These programs include constructing homes and schools, establishing potable water systems, and providing food and transportation stipends. In addition, paid community health workers are used to deliver top-quality health care to patients in their homes, rather than requiring sick, impoverished individuals to confront innumerable barriers to reaching clinics and hospitals. Such solutions, which privilege a biosocial approach to identifying and breaking down barriers to care, have resulted in remarkable successes in addressing epidemics of HIV/AIDS, TB, malaria, and other communicable and chronic diseases in some of the most challenging domestic and global settings.³³

SUMMARY

Poverty and infectious diseases interact in subtle and complex ways. Casting the problem of destitution as intractable, or epidemics that afflict the poor as accidental, erroneously exonerates us from responsibility for protecting and caring for those most in need. Our experience working in Haiti and Rwanda has shown that appropriately and adequately addressing the scourges of communicable diseases requires a biosocial appreciation of the structural forces that shape disease patterns. Although there is ample evidence that health investments pay dividends in labor productivity, educational attainment, population control, and, potentially, capital investments, the idea that health is an instrument for development should complement, not supplant, a rights-based approach to health equity. It is plausible that most health interventions in resource-poor settings could garner support based on cost/benefit ratios with appropriately lengthy time horizons to capture the return on health investments and an adequate accounting of externalities; however, such a calculus masks the untold suffering of inaction and risks eroding the most powerful incentive to act: redressing inequality.

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